SOLUTIA

Applied Chemistry, Creative Solutions

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November 11, 2002

Mr. Michael Ribordy
U. S. EPA - Region 5
77 West Jackson Boulevard (SR-6J)
Chicago, Illinois 60604-3590

Re: ` Response to Comments on Dead Creek Final Remedy Engineering Evaluation/Cost Analysis Sauget Area 1, Sauget and Cahokia, Illinois

Dear Mr. Ribordy:

Attached are Solutia' responses to the comments provided by the U. S. EPA on the Dead Creek Final Remedy Engineering Evaluation/Cost Analysis (EE/CA) submitted by Solutia on June 21, 2002. These comments were provided to us in your letter of October 1, 2002 and were discussed during a telephone call on October 14, 2002. The due date for the responses was amended from November 1, 2002 to November 12, 2002 in your e-mail message of October 22, 2002.

Your October 1 letter contained two separate sets of comments. The responses to the first of these, the comments on the EE/CA, are attached to this letter. The responses to the second set of comments, which dealt with the Ecological Risk Assessment, are being submitted under separate cover.

If you have any questions about the attached material, or about the responses to your comments on the Ecological Risk Assessment, please do not hesitate to call me at (618) 462-8538, or Richard Williams at (618) 482-6340.

Sincerely,
Solutia Inc.

Richard Williams

for Alan G. Faust
Project Coordinator

cc: Ken Bardo – USEPA
Sandra Bron - IEPA
Kevin de la Bruere - USF&W
Tim Gouger - USACE
Michael L. Henry – IDNR
Richard Ricci – Lowenstein Sandler
William Stone, Jr - Environ
Linda Tape – Husch, Eppenberger
Kevin Turner - USEPA
Sauget File - Solutia

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GENERAL COMMENTS

1. **Significant portions of the main text of this document are based on Volume 3, the residual ecological risk assessment. Our comments on Volume 3 were provided in a separate document, and should be incorporated into the main text in the relevant sections.**

Response: Volume 3 of the Dead Creek Final Remedy Engineering Evaluation/Cost Analysis (EE/CA) is the Ecological Risk Assessment (ERA) for residual constituent concentrations remaining in creek bottom soils after completion of the Time Critical Sediment Removal Action. As directed by USEPA, the ERA will be revised to incorporate comments made by Waterstone Environmental Hydrology and Engineering, Inc. and Laramide Environmental, LLC on September 19, 2002. A separate Response to Comments Document, which will be submitted separately from this EE/CA Response to Comments Document, was prepared to address these comments.

Based on the revised ERA, the areas of Dead Creek to be removed or isolated from the environment to eliminate ecological risk are:

Creek Segment	Transects	Risk Driver
CS-B	T0, T3	PAHs, PCBs
	T12, T16	PAHs
CS-D	T6	PCBs, Dioxin TEQ

Since the Time Critical Sediment Removal Action UAO (Docket No. V-W-99-C-54) requires lining of Creek Segment B, it is not necessary to take additional remedial action for creek bottom soils in this portion of Dead Creek to protect the environment other than to implement those remedial actions already required by the UAO. Specifically, the UAO requires the following:

> **Section 1. Jurisdiction and General Provisions** - "This Order also requires installation of a 40 millimeter [sic] (mil) high density polyethylene (HDPE) liner in CS-B and post removal sampling in all excavated areas. The post removal sampling results will be used in the Area One EE/CA and RI/FS process to determine what, if any, excavated areas in addition to CS-B may require further remediation under the EE/CA process."
>
> **Section V.3.B.5 Excavated Areas Bottom Liner Requirements** - "After excavation and sampling, Respondents shall properly install and maintain a 40 mil, HDPE liner in CS-B of Dead Creek. A liner shall be installed in other excavated areas of Site M and CS-C, D, E, a portion of F, and the basin area located at the lift station, as determined to be necessary based on post-excavation sampling to isolate impacted soils from surface water."

Installation of an armored, 40-mil, HDPE liner in CS-B will isolate creek bottom soils with residual constituent concentrations higher than the site-specific, risk-based concentrations needed to protect fish and piscivorous birds and mammals. Installation of an armored liner in CS-B will prevent: 1) isolate residual constituent concentrations in creek bottom soils and prevent contact with surface water and the aquatic ecosystem, 2) transport of residual constituent concentrations in creek bottom soils to other exposure points via the surface water pathway, 3) leaching of residual constituent concentrations in creek bottom soils via the surface water to groundwater migration pathway and 4) discharge of impacted groundwater from Sauget Area 1 Sites G, H and L to surface water.

Installation of a liner in CS-B will not prevent the leaching of residual constituent concentrations from creek bottom soils by the rise and fall of the groundwater. However, residual constituent migration via this pathway is not likely based on a comparison of predicted leaching concentrations and concentrations actually observed in groundwater downgradient of and adjacent to CS-B. Using the TACO Tier 2 Soil to Groundwater Remedial Objective process, 1,1,2,2-Tetrachoroethane, Cadmium, Dieldrin, Nitrobenzene and Pentachlorophenol are predicted to leach to groundwater at concentrations greater than the TACO Tier 1 Groundwater Remedial Objectives. Comparison of observed concentrations of these constituents at eight groundwater sampling stations downgradient or in the vicinity of Creek Segment B and Site M indicates that none of these constituents are present at concentrations higher than TACO Tier 1 Groundwater Remedial Objectives. For this reason, additional remedial action, other than installation of the liner in CS-B required by the Time Critical Sediment Removal Action UAO, is not considered necessary in Creek Segment B or Site M. Therefore, Creek Segment B will not be carried through the Feasibility Study process. Results of this analysis are presented in the Ecological Risk Assessment Response to Comment 6.

Based on the ecological risks identified by the revised Ecological Risk Assessment, it is considered appropriate to take additional remedial action at Creek Segment D Transect T6, which is located immediately upstream of Jerome Lane, to isolate or remove creek bottom soils with concentrations greater than site-specific, risk-based concentrations at this transect.

Section 1.6 Ecological Risk Assessment, Section 1.7 Engineering Evaluation/Cost Analysis, Section 2.4.2 Ecological Risk Assessment, Section 5.0 Detailed Analysis of Alternatives and Section 6.0 Comparative Analysis of Alternatives of the EE/CA will be revised as shown below to incorporate the need to isolate or remove creek bottom soils at Transect 6 of Creek Segment D.

1.6 Ecological Risk Assessment

Menzie-Cura & Associates, Inc. evaluated ecological risks due to Dead Creek bottom soils exposed after completion of the Dead Creek Sediment Removal Action, which removed impacted sediment down to native soils in Creek Segments B, C, D and E, the channel potion of Creek Segment F, Site M and the lift station sump at Prairie du Pont Creek.

Sediment and forage fish tissue analytical data from the Sauget Area 1 EE/CA and RI/FS Support Sampling Plan were used to calculate site-specific sediment to fish uptake values for bioaccumulative constituents detected in sediment and fish. These site-specific uptake factors, in conjunction with literature values for body burdens in fish associated with toxic effects, were used to back-calculate risk-based creek bottom soil concentrations protective of fish. These site-specific uptake factors were also used in food chain models to calculate risk-based creek bottom soil concentration protective of great blue heron. No risks were predicted for the river otter.

Risk-based concentrations were calculated for the following bioaccumulative COCs, which were selected by Waterstone Environmental, USEPA's oversight contractor for the Ecological Risk Assessment:

- **SVOCs** Total PAHs
- **Pesticides** Chlordane, DDT, Dieldrin
- **PCBs** Total PCBs
- **Dioxin** Dioxin TEQ
- **Metals** Mercury

Risk-based concentrations were compared to the 95% UCL concentrations in creek bottom soils for each creek segment except in Creek Segments C and D, where the maximum concentration was used because not enough data were available to calculate UCLs. Risks due to PAHs and PCBs were identified in Creek Segment B and risks due to PCBs and Dioxin were identified in Creek Segment D. If Transects T0, T3, T12 and T16 were removed from the CS-B creek bottom soil data set and Transect T6 was removed from the CS-D data set, UCLs in both creek segments would be below risk-based concentrations.

In summary, results from the Ecological Risk Assessment indicate that the transects listed below need to be isolated or removed from the creek channel in order to reduce potential ecological impacts resulting from impacted creek bottom soils to acceptable levels:

Creek Segment	Transects	Risk Driver
CS-B	T0, T3	PAHs, PCBs
	T12, T16	PAHs
CS-D	T6	PCBs, Dioxin TEQ

Since the Time Critical Sediment Removal Action UAO (Docket No. V-W-99-C-54) requires lining of Creek Segment B, it is not necessary to take additional remedial action for creek bottom soils in this portion of Dead Creek to protect the environment other than to implement those remedial actions already required by the UAO. Specifically, the UAO requires the following:

> **Section 1. Jurisdiction and General Provisions** - "This Order also requires installation of a 40 millimeter [sic] (mil) high density polyethylene (HDPE) liner in CS-B and post removal sampling in all excavated areas. The post removal sampling results will be used in the Area One EE/CA and RI/FS process to determine what, if any, excavated areas in addition to CS-B may require further remediation under the EE/CA process."
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> **Section V.3.B.5 Excavated Areas Bottom Liner Requirements** - "After excavation and sampling, Respondents shall properly install and maintain a 40 mil, HDPE liner in CS-B of Dead Creek. A liner shall be installed in other excavated areas of Site M and CS-C, D, E, a portion of F, and the basin area located at the lift station, as determined to be necessary based on post-excavation sampling to isolate impacted soils from surface water."

Installation of an armored, 40-mil, HDPE liner in CS-B will isolate creek bottom soils with residual constituent concentrations higher than the site-specific, risk-based concentrations needed to protect fish and piscivorous birds and mammals. Installation of an armored liner in CS-B will prevent: 1) isolate residual constituent concentrations in creek bottom soils and prevent contact with surface water and the aquatic ecosystem, 2) transport of residual constituent concentrations in creek bottom soils to other exposure points via the surface water pathway, 3) leaching of residual constituent concentrations in creek bottom soils via the surface water to groundwater migration pathway and 4) discharge of impacted groundwater from Sauget Area 1 Sites G, H and L to surface water.

Installation of a liner in CS-B will not prevent the leaching of residual constituent concentrations from creek bottom soils by the rise and fall of the groundwater. However, residual constituent migration via this pathway is not likely based on a comparison of predicted leaching concentrations and concentrations actually observed in groundwater downgradient of and adjacent to CS-B. Using the TACO Tier 2 Soil to Groundwater Remedial Objective process, 1,1,2,2-Tetrachoroethane, Cadmium, Dieldrin, Nitrobenzene and Pentachlorophenol are predicted to leach to groundwater at concentrations greater than the TACO Tier 1 Groundwater Remedial Objectives. Comparison of observed concentrations of these constituents at eight groundwater sampling stations downgradient or in the vicinity of Creek Segment B indicates that none of these constituents are present at concentrations higher than TACO Tier 1 Groundwater Remedial Objectives. For this reason, additional remedial action, other than installation of the liner required by the Time Critical Sediment Removal Action UAO, is not considered necessary in Creek Segment B. Therefore, Creek Segment B will not be carried through the Feasibility Study process.

Based on the ecological risks identified by the revised Ecological Risk Assessment, it is considered appropriate to take additional remedial action at Creek Segment D Transect T6, which is located immediately upstream of Jerome Lane, to isolate or remove creek bottom soils with concentrations greater than site-specific, risk-based concentrations at this transect. Remediation area and volume for Creek Segment D Transect 6 are estimated below:

Creek Segment	Transects Exceeding Risk Based Concentrations	Upstream Clean Transect	Downstream Clean Transect	Impacted Channel Length (Feet)	Impacted Channel Area ($Feet^2$)	Impacted Channel Volume ($Yards^3$)
• CS-D	T6	T5	T6 (1	125	12,500 (2	3,700 (3,4,5

Notes:
1) Transect 6 is located at the downstream end of Creek Segment D
2) Typical creek channel width in CS-D = 100 feet
3) Typical creek channel bottom elevation = EL 398 ft. amsl
4) Typical low groundwater elevation = EL 390 ft. amsl
5) Typical excavation depth = 8 ft.

1.7 Engineering Evaluation/Cost Analysis

1.7.1 Remedial Action Objectives

The following Remedial Action Objectives (RAOs) were identified for the Final Remedial Action in Dead Creek:

- Prevent or abate actual or potential exposure to nearby human populations, animals or the food chain from hazardous substances, pollutants or contaminants;
- Prevent or abate actual or potential contamination of surface water, groundwater and ecosystems;
- Achieve acceptable chemical-specific contaminant levels, or range of levels, for all applicable exposure routes; and
- Mitigate or abate other situations or factors that may pose threats to public health, welfare or the environment.

To achieve these RAOs, the Dead Creek Final Remedy should focus on protecting the health and welfare of residents living on or near the creek channel, protecting workers who perform invasive activities in the channel and abating or preventing adverse ecological impacts resulting from exposure to impacted creek bottom soils or surface water in contact with these soils. Site-specific, risk-based concentrations can be derived for constituents detected in creek bottom soils to identify those portions of the channel that pose unacceptable actual or potential risks to humans or ecosystems. Isolating creek bottom soils with concentrations above acceptable risk-based levels by installing a liner or by excavating and transferring them to the on-site containment cell will protect public health and environment.

For these reasons, the goal of the Dead Creek Final Remedy is to protect residents, workers and the aquatic ecosystem by isolating or removing impacted creek bottom soils with concentrations above acceptable, site-specific, risk-based concentrations and, thereby, abating or preventing:

- Exposure of human populations, animals or the food chain to contaminants;
- Contamination of surface water, groundwater and ecosystems;
- Chemical-specific contamination for all applicable exposure routes; and
- Threats to public health, welfare or the environment.

Surface water quality and fish tissue bioaccumulation monitoring for PCBs and Dioxin in Creek Segments C, D and E and the channel portion of Creek Segment F are appropriate performance measures for these Dead Creek Final Remedy objectives. Surface water quality and fish tissue bioaccumulation monitoring are not appropriate for Creek Segment B because this portion of Dead Creek will be isolated from the environment by installation of an armored, HDPE liner.

1.7.2 Remedial Action Alternatives

This section presents evaluation of alternatives in the context of specific evaluation criteria developed to address CERCLA requirements and technical and policy considerations proven to be important for selecting remedial alternatives. The Human Health Risk Assessment (Section 2.4.1) indicates there are no unacceptable risks to recreational teenagers and/or construction workers resulting from exposure to creek bottom soils. The Ecological Risk Assessment (Section 2.4.2) indicates there is an adverse impact resulting from exposure to creek bottom soils within portions of Creek Segment B (Transects T0, T3, T12 and T16) and Creek Segment D (Transect T6). Since the Time Critical Sediment Removal Action UAO requires lining of Creek Segment B, it is not necessary to take additional remedial action for creek bottom soils in this portion of Dead Creek to protect the environment other than to implement those remedial actions already required by the UAO. Therefore, Creek Segment B will not be included in the analysis of remedial action alternatives.

Further remedial action for creek bottom soils in Creek Segment D of Dead Creek is appropriate to protect ecological receptors. Containment and removal with on-site disposal and ex-situ treatment and/or disposal for any soil that can not be transferred to the on-site containment cell are the only remedial technologies that are implementable and will be effective at managing the risks associated with Creek Segment D Transect T6 (Figure 1-2). For that reason, only the three alternatives listed below are compared in this Engineering Evaluation/Cost Assessment.

- **Creek Bottom Soils Alternative A – No Action**

- **Creek Bottom Soils Alternative B – Containment**

- Institutional Controls
- Containment
- Monitoring
  - Surface Water Quality
  - Fish Tissue Bioaccumulation

- **Creek Bottom Soils Alternative C – Removal**

- Institutional Controls
- Removal
  - Excavation and On-Site Disposal For Soil Volumes Up To 20,000 CY
  - Excavation and Off-Site Treatment For Soil Volumes In Excess of 20,000 CY
- Monitoring
  - Surface Water Quality
  - Fish Tissue Bioaccumulation

This suite of remedial alternatives is intended to be representative of the remedial alternatives that are available, rather than inclusive of all possible approaches. The use of these alternatives in this EE/CA does not necessarily preclude the use of more than one alternative throughout Dead Creek, or the selection of different process options for containment or disposal, assuming those other alternatives are implementable and effective. For example, some portions of the creek may be treated by excavation and disposal while others are contained.

1.7.3 Comparative Analysis of Alternatives

In the following sections, Creek Bottom Soil Remedial Alternatives A (No Action), B (Containment) and C (Excavation and Disposal) are compared to one another to identify the relative advantages and disadvantages of each. A forced ranking system was used to identify the alternative that best achieves the requirements of the seven evaluation criteria used to evaluate remedial alternatives. In this forced ranking system, the alternative that best meets the requirements of a criterion was awarded a score of 1, the second best alternative was awarded a score of 2 and the third best alternative was awarded a score of 3. Using this ranking method, the alternative with the lowest score is the one that best meets the requirements of the seven criteria. The comparative analysis is summarized in the following table:

	Alternative A **(No Action)**	***Alternative B*** **(Containment)**	***Alternative C*** **(Removal)**
Threshold Criteria			
• Overall Protection of Human Health and the Environment	3	2	1
• Compliance with ARARs	3	2	1
Subtotal	**6**	**4**	**2**
Balancing Criteria			
• Long-term Effectiveness and Permanence	3	2	1
• Reduction of Toxicity, Mobility or Volume Through Treatment	3	2	1
• Short-Term Effectiveness	3	2	1
• Implementability	1	3	2
• Cost	1	2	3
Subtotal	**11**	**11**	**8**
Total Score	**17**	**15**	**10**

While Alternative A is clearly in lower cost and more readily implementable, Alternatives B and C are more effective short term and are the better alternatives for protecting public health and the environment, complying with ARARs, providing long-term effectiveness and permanence and reducing mobility, toxicity or volume. Alternative C scores higher than Alternative B because it removes creek bottom soils with residual concentrations higher than site-specific risk based concentrations from the creek channel. In addition, Alternative C provides more reduction of mobility, toxicity and volume than Alternative B. Alternative B and Alternative C can both achieve compliance with ARARs. Alternative C (Removal) is considered to be better able to achieve ARARs than Alternative B (Containment). Alternative B provides effective protection of public health and the environment at a lower cost than Alternative C.

Overall Protection of Human Health and the Environment - Alternative A does not provide for additional protection of human health and the environment, but is already adequately protective of human health based on the risk assessment.

Alternative B provides for protection of human health and the environment by installing a physical barrier in CS-D to isolate impacted soils from ecological receptors and to reduce the transport of COCs via storm water. A 125 ft. long liner will be installed in Creek Segment D, starting at the upstream side of Jerome Lane, to isolate impacted soils from the environment. This composite liner will be comprised of a nonwoven geotextile base layer, a 40-mil HDPE liner, a nonwoven geotextile protective layer and rip-rap armoring. Alternative B is more protective of human health and the environment than Alternative A.

Alternative C provides for protection of human health by removal of impacted soils with COC concentrations higher than the site-specific, risk-based concentrations from Creek Segment D. This removal will eliminate exposure to ecological receptors and allow for the subsequent isolation of COCs in the on-site containment cell. Alternative C entails removal of 3,700 cubic yards of creek bottom soil from a total of 125 linear feet of Dead Creek (CS-D Transects T5 to T6). Since soil volumes do not exceed the available 20,000 cubic yard capacity of the on-site containment cell, transportation of excavated soils to a commercial incineration facility permitted to treat PCBs and the other constituents present in the excavated soil is not necessary and will not be evaluated further.

Alternative C is more protective of human health and the environment than Alternative B because creek bottom soils with residual constituent concentrations above site-specific, risk-based levels will be permanently removed from the creek channel and transferred to the on-site containment cell constructed adjacent to Creek Segment B during implementation of the Time Critical Sediment Removal Action.

Compliance with ARARS - Alternatives A, B and Alternative C achieve compliance with ARARs.

Long-Term Effectiveness and Permanence - *Alternative* A *provides no long-term* effectiveness and permanence. Alternative C provides more long-term effectiveness and permanence than Alternative B because creek bottom soils with residual constituent concentrations above site-specific, risk-based levels will be permanently removed from the creek channel and transferred to the on-site containment cell constructed adjacent to Creek Segment B during implementation of the Time Critical Sediment Removal Action.

Reduction of Toxicity, Mobility or Volume through Treatment - Groundwater Alternative A relies on natural processes to reduce the toxicity, mobility and volume of contaminants. Alternative B reduces the mobility of contaminants by physical containment of creek bottom soils. Alternative C reduces the mobility of contaminants through the removal of creek bottom soils. In the long term, both Alternative B and Alternative C also reduce the toxicity and volume of soil contaminants through the action of natural processes, such as biodegradation, adsorption, dilution and chemical reactions with subsurface materials. However, Alternative C is more effective than Alternative B at reducing the toxicity and volume of soil contaminants through its use of excavation and on-site containment. Both Alternatives B and C are more effective than Alternative A in reducing toxicity, mobility or volume. However Alternative C reduces toxicity, mobility and volume more than Alternative B because it relies on removal and on-site containment instead of in-place containment.

Short-Term Effectiveness - Alternative A is not effective in controlling threats to the environment in the short term because it relies on long-term, natural processes to reduce the adverse ecologic impacts associated with certain of the creek bottom soils. Natural processes will not reduce adverse impacts to ecological receptors in the short term due to the nature of COCs.

Alternative C more quickly mitigates the adverse surface water impacts resulting from transport of creek bottom soil COCs than Alternative B because of the faster implementation time frame. Consequently, Alternative C is more effective in the short term than Alternative B.

Implementation of Alternative B and Alternative C pose minimal short-term risk to human health and the environment.

Implementability - Alternative A is more readily implementable than Alternative B or Alternative C because no action is required to implement this alternative. Alternative C can be implemented more readily than Alternative B because all that is required to implement this alternative is excavation of creek bottom soils with residual concentrations higher than the site-specific, risk-based concentrations established by the Ecological Risk Assessment and transfer of these soils to the on-site containment cell. Both of these alternatives are implementable with conventional materials and equipment.

Cost - No costs are associated with Alternative A. Alternative B ($667,889) is less expensive than Alternative C ($1,330,295) on a 30-year present value basis and provides similar protection of public health and the environment.

Estimated costs for each alternative are summarized below:

Project Element	Alternative B (Containment)	Alternative C (Removal)
Institutional Controls	155,113	155,113
Monitoring	453,426	453,426
Remedial Action	46,423	697,264
Operation and Maintenance	12,927	24,492
30-Year Present Value Cost	$667,889	$1,330,295

2.4.2 Ecological Risk Assessment

Menzie-Cura & Associates, Inc. evaluated ecological risks due to Dead Creek bottom soils exposed after completion of the Dead Creek Sediment Removal Action, which removed impacted sediment down to native soils in Creek Segments B, C, D and E, the channel potion of Creek Segment F, Site M and the lift station sump at Prairie du Pont Creek.

Sediment and forage fish tissue analytical data from the Sauget Area 1 EE/CA and RI/FS Support Sampling Plan were used to calculate site-specific sediment to fish uptake values for bioaccumulative constituents detected in sediment and fish. These site-specific uptake factors, in conjunction with literature values for body burdens in fish associated with toxic effects, were used to back-calculate risk-based creek bottom soil concentrations protective of fish. These site-specific uptake factors were also used in food chain models to calculate risk-based creek bottom soil concentration protective of great blue heron. No risks were predicted for the river otter.

Risk-based concentrations were calculated for the following bioaccumulative COCs, which were selected by Waterstone Environmental, USEPA's oversight contractor for the Ecological Risk Assessment:

- **SVOCs** Total PAHs
- **Pesticides** Chlordane, DDT, Dieldrin
- **PCBs** Total PCBs
- **Dioxin** Dioxin TEQ
- **Metals** Mercury

Risk-based concentrations were compared to the 95% UCL concentrations in creek bottom soils for each creek segment except in Creek Segments C and D, where the maximum concentration was used because not enough data were available to calculate UCLs. Risks due to PAHs and PCBs were identified in Creek Segment B and risks due to PCBs and Dioxin were identified in Creek Segment D. If Transects T0, T3, T12 and T16 were removed from the CS-B creek bottom soil data set and Transect T6 was removed from the CS-D data set, UCLs in both creek segments would be below risk-based concentrations.

In summary, results from the Ecological Risk Assessment indicate that the transects listed below need to be isolated or removed from the creek channel in order to reduce potential ecological impacts resulting from impacted creek bottom soils to acceptable levels:

Creek Segment	Transects	Risk Driver
CS-B	T0, T3	PAHs, PCBs
	T12, T16	PAHs
CS-D	T6	PCBs, Dioxin TEQ

Since the Time Critical Sediment Removal Action UAO (Docket No. V-W-99-C-54) requires lining of Creek Segment B, it is not necessary to take additional remedial action for creek bottom soils in this portion of Dead Creek to protect the environment other than to implement those remedial actions already required by the UAO. Specifically, the UAO requires the following:

> **Section 1. Jurisdiction and General Provisions** - "This Order also requires installation of a 40 millimeter [sic] (mil) high density polyethylene (HDPE) liner in

> CS-B and post removal sampling in all excavated areas. The post removal sampling results will be used in the Area One EE/CA and RI/FS process to determine what, if any, excavated areas in addition to CS-B may require further remediation under the EE/CA process."
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> **Section V.3.B.5 Excavated Areas Bottom Liner Requirements** - "After excavation and sampling, Respondents shall properly install and maintain a 40 mil, HDPE liner in CS-B of Dead Creek. A liner shall be installed in other excavated areas of Site M and CS-C, D, E, a portion of F, and the basin area located at the lift station, as determined to be necessary based on post-excavation sampling to isolate impacted soils from surface water."

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Installation of a liner in CS-B will not prevent the leaching of residual constituent concentrations from creek bottom soils by the rise and fall of the groundwater. However, residual constituent migration via this pathway is not likely based on a comparison of predicted leaching concentrations and concentrations actually observed in groundwater downgradient of and adjacent to CS-B. Using the TACO Tier 2 Soil to Groundwater Remedial Objective process, 1,1,2,2-Tetrachoroethane, Cadmium, Dieldrin, Nitrobenzene and Pentachlorophenol are predicted to leach to groundwater at concentrations greater than the TACO Tier 1 Groundwater Remedial Objectives. Comparison of observed concentrations of these constituents at eight groundwater sampling stations downgradient or in the vicinity of Creek Segment B indicates that none of these constituents are present at concentrations higher than TACO Tier 1 Groundwater Remedial Objectives. For this reason, additional remedial action, other than installation of the liner required by the Time Critical Sediment Removal Action UAO, is not considered necessary in Creek Segment B. Therefore, Creek Segment B will not be carried through the Feasibility Study process.

Based on the ecological risks identified by the revised Ecological Risk Assessment, it is considered appropriate to take additional remedial action at Creek Segment D Transect T6, which is located immediately upstream of Jerome Lane, to isolate or remove creek bottom soils with concentrations greater than site-specific, risk-based concentrations at this transect. Remediation area and volume for Creek Segment D Transect 6 are estimated below:

Creek Segment	Transects Exceeding Risk Based Concentrations	Upstream Clean Transect	Downstream Clean Transect	Impacted Channel Length (Feet)	Impacted Channel Area ($Feet^2$)	Impacted Channel Volume ($Yards^3$)
• CS-D	T6	T5	T6 [(1]	125	12,500 [(2]	3,700 [(3,4,5]

Notes:
1) Transect 6 is located at the downstream end of Creek Segment D
2) Typical creek channel width in CS-D = 100 feet
3) Typical creek channel bottom elevation = EL 398 ft. amsl
4) Typical low groundwater elevation = EL 390 ft. amsl
5) Typical excavation depth = 8 ft.

5.0 DETAILED ANALYSIS OF ALTERNATIVES

This section presents evaluation of alternatives in the context of specific evaluation criteria developed to address CERCLA requirements and technical and policy considerations proven to be important for selecting remedial alternatives. The Human Health Risk Assessment (Section 2.4.1) indicates there are no unacceptable risks to recreational teenagers and/or construction workers resulting from exposure to creek bottom soils. The Ecological Risk Assessment (Section 2.4.2) indicates there is an adverse impact resulting from exposure to creek bottom soils within portions of Creek Segment B (Transects T0, T3, T12 and T16) and Creek Segment D (Transect T6). Since the Time Critical Sediment Removal Action UAO requires lining of Creek Segment B, it is not necessary to take additional remedial action for creek bottom soils in this portion of Dead Creek to protect the environment other than to implement those remedial actions already required by the UAO. Therefore, Creek Segment B will not be included in the analysis of remedial alternatives.

Further remedial action for creek bottom soils in Creek Segment D of Dead Creek is appropriate to protect ecological receptors. Containment and removal with on-site disposal and ex-situ treatment and/or disposal for any soil that can not be transferred to the on-site containment cell are the only remedial technologies that are implementable and will be effective at managing the risks associated with Creek Segment D Transect T6 (Figure 5-1). For that reason, only the three alternatives listed below are compared in this Engineering Evaluation/Cost Assessment.

- **Creek Bottom Soils Alternative A – No Action**

- **Creek Bottom Soils Alternative B – Containment**

- Institutional Controls
- Containment
- Monitoring
  - Surface Water Quality
  - Fish Tissue Bioaccumulation

- **Creek Bottom Soils Alternative C – Removal**

- Institutional Controls
- Removal
  - Excavation and On-Site Disposal For Soil Volumes Up To 20,000 CY
  - Excavation and Off-Site Treatment For Soil Volumes In Excess of 20,000 CY
- Monitoring
  - Surface Water Quality
  - Fish Tissue Bioaccumulation

This suite of remedial alternatives is intended to be representative of the remedial alternatives that are available, rather than inclusive of all possible approaches. The use of these alternatives in this EE/CA does not necessarily preclude the use of more than one alternative throughout Dead Creek, or the selection of different process options for containment or disposal, assuming those other alternatives are implementable and effective. For example, some portions of the creek may be treated by excavation and disposal while others are contained.

The No Action, Containment, and Excavation and Disposal alternatives are discussed in Sections 5.1, 5.2 and 5.3, respectively. Feasibility Study guidance requires that these alternatives be evaluated according to the following criteria:

- Threshold Criteria
  - Overall protection of human health and the environment
  - Compliance with ARARs

- Balancing Criteria
  - Long-term effectiveness and permanence
  - Reduction of toxicity, mobility or volume
  - Short-term effectiveness
  - Implementability
  - Cost

- Regulatory/Community Criteria
  - State acceptance
  - Community acceptance

These nine evaluation criteria are used to assess the benefits, projected costs and risks associated with each remedial alternative, on an individual basis. EPA will consider and address both State and community acceptance of an alternative when making a recommendation and in the final selection of a remedy. Consequently, these criteria are not addressed in this report.

5.1 Creek Bottom Soils Alternative A – No Action

This alternative includes no actions to address Creek bottom soil in Sauget Area 1 except those required by the Time Critical Sediment Removal Action UAO. Section V.3.B.5 of this Order, Excavated Areas Bottom Liner Requirements, requires lining of Creek Segment B.

5.1.1 *Overall Protection of Human Health and the Environment*

Based on the results of the human health risk assessment, implementation of the No Action alternative will be protective of human health. However, implementation of the No Action alternative will not protect the ecological receptors from risks associated with residual PCB and Dioxin concentrations in creek bottom soil at Transect T6 in Creek Segment D.

5.1.2 *Compliance with ARARs*

Creek Bottom Soil Alternative A – No Action, does achieve compliance with ARARs. A No Action alternative will not adversely impact floodplains or wetlands, so it is compliant with location-specific ARARs. Neither chemical-specific nor action-specific ARARs apply because there are no actions.

5.1.3 Long-Term Effectiveness and Permanence

Since no action is taken to abate the risks to ecological receptors at Creek Segment D T6, a No Action alternative is unlikely to be an effective or permanent long-term remedy.

5.1.4 Reduction of Toxicity, Mobility or Volume

Over time, natural remediation processes will reduce the toxicity, mobility and volume of contaminants in the exposure zone. These processes include biodegradation, biotransformation, bioturbation, diffusion, dilution, adsorption, volatilization, chemical and biochemical stabilization of contaminants, and burial by natural deposition of cleaner sediments. However, this alternative does not provide for treatment beyond that afforded by natural processes, and may not achieve an appropriate degree of risk reduction within a reasonable timeframe.

5.1.5 Short-Term Effectiveness

While the baseline risk assessment has identified no unacceptable risk to humans, the potential risk to ecological receptors will not be addressed if a No Action alternative is implemented. In addition, a No Action alternative will not mitigate the potential transport of impacted soils through erosion.

5.1.6 Implementability

This alternative is readily implementable.

5.1.7 Cost

No costs are associated with this alternative.

5.2 Creek Bottom Soils Alternative B – Containment

Alternative B includes the following elements:

- Institutional Controls
- Containment
- Monitoring
  - Surface Water Quality
  - Fish Tissue Bioaccumulation

Institutional Controls - This alternative includes institutional controls in combination with containment of creek bottom soil by a composite, rip-rap armored liner. Institutional controls will be utilized to ensure the effectiveness of the containment remedy. Existing fencing at Creek Segment B and Site M will be used as an institutional control to enhance protection of the channel liner. Other institutional controls could include warning signs posted at the top of the creek bank in Creek Segments B and D to notify the public and/or workers about the presence of an impermeable membrane below the rip-rap and measures needed to protect the integrity of the HDPE liner. Routine maintenance and inspection of the condition and effectiveness of the institutional controls will be performed. Inspections will be conducted annually.

Containment - Containment with an armored impermeable liner will be utilized to remediate creek bottom soil in Creek Segment D 125 feet upstream of Jerome Lane (Figure 5-1).

Construction of the armoring system should not require grubbing to remove vegetation and debris, as sediment excavation was recently completed. Some limited contouring may be conducted to achieve surface configurations and slopes that facilitate the installation of the cap, and that will allow for a stable finished cap. An allowance will be made for disposal of a limited volume of soils removed to achieve sub-base grading. The cap will consist of:

- Base Geotextile;
- 40-mil HDPE Liner;
- Covering Geotextile; and
- Rip-rap.

Performance of the remedial action will be monitored to determine the effectiveness of the liner in preventing erosion and entrainment and/or solubilization of COCs. Surface water will be sampled quarterly sampling at the upstream and downstream of lined sections of Creek Segments B and D and the samples will be analyzed for PCBs and Dioxin. Fish tissue samples will be collected annually in Creek Segment B and D and analyzed for PCBs and Dioxin to evaluate the performance of the channel liners in preventing or mitigating bioaccumulation of COCs.

Surface water samples will be collected quarterly at the downstream ends of Creek Segments C, E and the channel portion of F and analyzed for PCBs and Dioxin to determine if these constituents are entrained in surface water. Fish tissue samples will be collected annually in Creek Segments C, E and the channel portion of F to determine if these constituents are bioaccumulating in fish tissue.

Performance monitoring will be done for five years and discontinued unless the five-year remedy review indicates that continued performance monitoring is appropriate.

5.2.1 Overall Protection of Human Health and the Environment

Based on the results of the Human Health Risk Assessment, creek bottom soils present no unacceptable risk to humans. Protection of ecological receptors, specifically fish, through elimination of exposure to PCBs and Dioxin in creek bottom soil at Creek Segment D T6 is warranted based on the results of the Ecological Risk Assessment. Containment of impacted creek bottom soil will protect ecological receptors from adverse impacts. Protection will be achieved by isolating impacted soils beneath an impermeable liner and a layer of rip-rap. This system will prevent direct contact with impacted sediments, and will prevent the transport of sediments via run-off to other potential exposure points. Regular inspection of the containment system will be conducted to ensure that the system remains protective.

5.2.2 Compliance with ARARs

A containment alternative, as included in Alternative B, meets the objective of isolating impacted soil, preventing the transport of COCs through run-off and preventing or mitigating aquatic impacts. Because this alternative involves filling a portion of the channel with rip-rap, provision of additional storm water storage capacity may be necessary to achieve compliance with location-specific ARARs. Sediment removal deepened the channel and may provide all of the increased storm water storage necessary to offset the effect of installing an armored liner in the channel. Creek Bottom Soil Alternative B will also achieve compliance with action-specific ARARs.

5.2.3 Long-Term Effectiveness and Permanence

An armored lining system in the impacted sections of the Dead Creek channel will provide the benefit of isolating impacted soils, preventing the transport of COCs through run-off to the point where aquatic impact is reduced to acceptable levels and preventing the discharge of impacted groundwater to surface water. Moreover, the channel lining system will be durable and easily maintained. The institutional controls provide effective protection of human health, and ensure the long-term integrity of the cap system. As such, the containment alternative will provide greater long-term effectiveness and permanence than the No Action Alternative.

5.2.4 Reduction of Toxicity, Mobility or Volume

This alternative reduces the mobility of contaminants in creek bottom soils by providing a physical barrier to prevent the transport of soils via run-off. In the long term, this alternative may also reduce the toxicity and volume of COCs through the action of natural processes, such as biodegradation, adsorption, dilution and chemical reactions with subsurface materials.

5.2.5 Short-Term Effectiveness

Physical containment more quickly mitigates the potential for exposure to, or transport of, Creek bottom soil than the No Action Alternative. The time needed to design, approve, procure, and construct containment system is expected to be on the order of 6 months.

Implementation of this alternative will present minimal risk to human health and the environment. Potential exposure to soils while installing the composite cap will be controlled by the use of appropriate health and safety procedures.

5.2.6 Implementability

Installation of the channel lining can be accomplished with conventional materials and equipment. Rip-rap and HDPE liners are commercially available products. Placement of these products utilizes commercially available equipment, such as trackhoes, excavators and dump trucks. Location-specific considerations related to the degree of contouring necessary for construction can be readily defined during the final remedial design stage.

5.2.7 Cost

The cost for this alternative, including capital costs, monitoring and reporting costs and annual maintenance costs, on a present value (PV) basis is as follows.

Description	Capital Cost	O&M Cost (PV)	Total Cost (PV)
Institutional Controls	0	155,113	155,113
Containment	46,423	$12,927	59,350
Monitoring	0	453,426	453,426
Total	$46,423	$621,466	$667,889

The cost presented above is based on continuing corrective action for 30 years, which is considered appropriate for comparative purposes. A discount rate of 7% was used in the cost calculations. Costs were derived primarily from the ECHOS *Environmental Remediation: Assemblies Cost Book*, 1998 and RS Means Construction Cost Data. Costs were developed in accordance with USEPA Publication No. 9355.0-75, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, July 2000. This is an order-of-magnitude engineering cost estimate that is expected to be within -30 to +50% of the actual project cost. A more complete breakdown of the cost estimate is provided in Table 5-1.

5. 3 Creek Bottom Soils Alternative C – Removal

This alternative includes the following elements:

- Institutional Controls
- Removal
  - Excavation and On-Site Disposal For Soil Volumes Up To 20,000 CY
  - Excavation and Off-Site Treatment For Soil Volumes In Excess of 20,000 CY
- Monitoring
  - Surface Water Quality
  - Fish Tissue Bioaccumulation

Institutional controls - This alternative includes institutional controls to ensure continued integrity of the on-site containment cell.

Excavation - Removal through excavation is a common practice for managing contaminated soils. Soil excavation has previously been employed for segments of Dead Creek. These removal actions were completed using conventional excavation equipment (e.g. long-stick, tracked excavator). Removal requires the following related activities:

- Erosion control and storm water management to minimize complications during implementation, to mitigate contaminant transport, and to prevent further erosion following the remedial action. Grading, silt traps, silt fences, pumps and diversion piping will be utilized where necessary to manage water and retain suspended solids.
- For soils removed from wetter locations, local stockpiling of excavated materials may be required to allow for gravity drainage of entrained water. Addition of a solidification agent

may also be appropriate. This dewatering will facilitate handling, transportation, treatment and disposal.

- Dewatering of ponded water areas prior to excavation.
- Treatment of water extracted from isolated pools or expressed from the soils using silt traps to retain suspended solids prior to discharge to the creek.

On-Site Disposal - On-site disposal involves the use of the existing on-site containment cell constructed for the Time-Critical Sediment Removal Action. This containment cell has approximately 20,000 cubic yards of remaining capacity and would be the initial disposal option for Alternative C.

Off-Site Treatment - Off-site treatment involves the thermal treatment of creek bottom soil at an off-site commercial incinerator. For Alternative C, ex-situ treatment through incineration would be utilized for those soils that could not be disposed of in the on-site containment cell, due to capacity limitations. Since excavation volumes (3,700 cubic yards) are less than the remaining cell capacity (20,000 cubic yards) off-site treatment is not necessary.

5.3.1 Overall Protection of Human Health and the Environment

Based on the results of the Human Health Risk Assessment, creek bottom soils present no unacceptable risk to humans. Protection of ecological receptors, specifically fish, through elimination of exposure to PCBs and Dioxin in creek bottom soil at Creek Segment D Transect T6 is warranted based on the results of the Ecological Risk Assessment. Removal of creek bottom soil between Creek Segment D Transect 5 and Jerome Lane will protect ecological receptors from adverse impacts. Protection will be achieved by excavation and transfer of the excavated soils to the on-site containment cell constructed during implementation of the Time Critical Sediment Removal Action.

Implementation of institutional controls (fencing and warning signs) will protect the integrity of the on-site containment cell.

5.3.2 Compliance with ARARs

A removal alternative, as included in Alternative C, meets the objective of isolating impacted soil, preventing the transport of COCs through run-off and preventing or mitigating aquatic impacts. Because this alternative involves regrading a portion of the channel, provision of additional storm water storage capacity may be necessary to achieve compliance with location-specific ARARs. Sediment removal deepened the channel and may provide all of the increased storm water storage necessary to offset the effect of channel regrading. Creek Bottom Soils Alternative C will also achieve compliance with action-specific ARARs as well as chemical-specific ARARs:

5.3.3 Long-Term Effectiveness and Permanence

Removal of impacted creek bottom soil will permanently eliminate the potential for exposure to, or transport of, COCs to the point where aquatic impact is reduced to acceptable levels. As such, the removal alternative will provide greater long-term effectiveness and permanence than the No Action Alternative.

5.3.4 Reduction of Toxicity, Mobility or Volume

This alternative reduces the mobility of contaminants through removal and disposal. Removal also reduces the volume of impacted soils in Dead Creek. The mobility and toxicity of COCs are reduced through containment of the impacted soils in the on-site, TSCA and RCRA-compliant containment cell.

5.3.5 Short-Term Effectiveness

Removal more quickly mitigates the potential for exposure to, or transport of, creek bottom soil in Dead Creek than the No Action Alternative. The time needed to complete the soil removal is expected to be less than 6 months.

Implementation of this alternative will present minimal risk to human health and the environment. Potential exposure to COCs while conducting the removal and waste management activities will be controlled by the use of appropriate health and safety procedures.

5.3.6 Implementability

Removal of creek bottom sediments was previously conducted in Dead Creek, and soil removal is readily implementable via the same methods. Removal can be accomplished with readily available materials and equipment. There are currently 20,000 cubic yards of disposal capacity remaining in the on-site containment cell. Excavated soil in excess of this amount would require treatment at an off-site incinerator if land-disposal restrictions were triggered. Only one commercial incineration facility in the United States is currently licensed to accept PCBs and this facility may have capacity limitations that could be exacerbated by the presence of volatile metals in the excavated creek bottom soils.

5.3.7 Cost

The cost for this alternative, including capital costs, monitoring and reporting costs and annual maintenance costs, on a present value (PV) basis is as follows:

Description	Capital Cost	O&M Cost (PV)	Total Cost (PV)
Institutional Controls	0	155,113	155,113
Removal	697,264	24,492	721,756
Monitoring	0	453,426	453,426
Total	$697,264	$633,031	$1,330,295

The cost presented above is based on continuing corrective action for 30 years, which is considered appropriate for comparative purposes. A discount rate of 7% was used in the cost calculations. Costs were derived primarily from the ECHOS *Environmental Remediation: Assemblies Cost Book*, 1998 and RS means Construction Cost data. Costs were developed in accordance with USEPA Publication No. 9355.0-75, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, July 2000. This is an order-of-magnitude engineering cost estimate that is expected to be within -30 to +50% of the actual project cost. A more complete breakdown of the cost estimate is provided in Table 5-2.

6.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

In the following sections, Creek Bottom Soil Remedial Alternatives A (No Action), B (Containment) and C (Excavation and Disposal) are compared to one another to identify the relative advantages and disadvantages of each. A forced ranking system was used to identify the alternative that best achieves the requirements of the seven evaluation criteria used to evaluate remedial alternatives. In this forced ranking system, the alternative that best meets the requirements of a criterion was awarded a score of 1, the second best alternative was awarded a score of 2 and the third best alternative was awarded a score of 3. Using this ranking method, the alternative with the lowest score is the one that best meets the requirements of the seven criteria. The comparative analysis is summarized in the following table:

	Alternative A (No Action)	Alternative B (Containment)	Alternative C (Removal)
Threshold Criteria			
• Overall Protection of Human Health and the Environment	3	2	1
• Compliance with ARARs	3	2	1
Subtotal	**6**	**4**	**2**
Balancing Criteria			
• Long-term Effectiveness and Permanence	3	2	1
• Reduction of Toxicity, Mobility or Volume Through Treatment	3	2	1
• Short-Term Effectiveness	3	2	1
• Implementability	1	3	2
• Cost	1	2	3
Subtotal	**11**	**11**	**8**
Total Score	**17**	**15**	**10**

While Alternative A is clearly in lower cost and more readily implementable, Alternatives B and C are more effective short term and are the better alternatives for protecting public health and the environment, complying with ARARs, providing long-term effectiveness and permanence and reducing mobility, toxicity or volume. Alternative C scores higher than Alternative B because it removes creek bottom soils with residual concentrations higher than site-specific risk based concentrations from the creek channel. In addition, Alternative C provides more reduction of mobility, toxicity and volume than Alternative B. Alternative B and Alternative C can both achieve compliance with ARARs. Alternative C (Removal) is considered to be better able to achieve ARARs than Alternative B (Containment). Alternative B provides effective protection of public health and the environment at a lower cost than Alternative C.

Overall Protection of Human Health and the Environment - Alternative A does not provide for additional protection of human health and the environment, but is already adequately protective of human health based on the risk assessment.

Alternative B provides for protection of human health and the environment by installing a physical barrier in CS-D to isolate impacted soils from ecological receptors and to reduce the transport of COCs via storm water. A 125 ft. long liner will be installed in Creek Segment D, starting at the upstream side of Jerome Lane, to isolate impacted soils from the environment. This composite liner will be comprised of a nonwoven geotextile base layer, a 40-mil HDPE liner, a nonwoven geotextile protective layer and rip-rap armoring. Alternative B is more protective of human health and the environment than Alternative A.

Alternative C provides for protection of human health by removal of impacted soils with COC concentrations higher than the site-specific, risk-based concentrations from Creek Segment D. This removal will eliminate exposure to ecological receptors and allow for the subsequent isolation of COCs in the on-site containment cell. Alternative C entails removal of 3,700 cubic yards of creek bottom soil from a total of 125 linear feet of Dead Creek (CS-D Transects T5 to T6). Since soil volumes do not exceed the available 20,000 cubic yard capacity of the on-site containment cell, transportation of excavated soils to a commercial incineration facility permitted to treat PCBs and the other constituents present in the excavated soil is not necessary and will not be evaluated further.

Alternative C is more protective of human health and the environment than Alternative B because creek bottom soils with residual constituent concentrations above site-specific, risk-based levels will be permanently removed from the creek channel and transferred to the on-site containment cell constructed adjacent to Creek Segment B during implementation of the Time Critical Sediment Removal Action.

Compliance with ARARS - Alternatives A, B and Alternative C achieve compliance with ARARs.

Long-Term Effectiveness and Permanence - Alternative A provides no long-term effectiveness and permanence. Alternative C provides more long-term effectiveness and permanence than Alternative B because creek bottom soils with residual constituent concentrations above site-specific, risk-based levels will be permanently removed from the creek channel and transferred to the on-site containment cell constructed adjacent to Creek Segment B during implementation of the Time Critical Sediment Removal Action.

Reduction of Toxicity, Mobility or Volume through Treatment - Groundwater Alternative A relies on natural processes to reduce the toxicity, mobility and volume of contaminants.

Alternative B reduces the mobility of contaminants by physical containment of creek bottom soils. Alternative C reduces the mobility of contaminants through the removal of creek bottom soils. In the long term, both Alternative B and Alternative C also reduce the toxicity and volume of soil contaminants through the action of natural processes, such as biodegradation, adsorption, dilution and chemical reactions with subsurface materials. However, Alternative C is more effective than Alternative B at reducing the toxicity and volume of soil contaminants through its use of excavation and on-site containment. Both Alternatives B and C are more effective than Alternative A in reducing toxicity, mobility or volume. However Alternative C reduces toxicity, mobility and volume more than Alternative B because it relies on removal and on-site containment instead of in-place containment.

Short-Term Effectiveness - Alternative A is not effective in controlling threats to the environment in the short term because it relies on long-term, natural processes to reduce the adverse ecologic impacts associated with certain of the creek bottom soils. Natural processes will not reduce adverse impacts to ecological receptors in the short term due to the nature of COCs.

Alternative C more quickly mitigates the adverse surface water impacts resulting from transport of creek bottom soil COCs than Alternative B because of the faster implementation time frame. Consequently, Alternative C is more effective in the short term than Alternative B.

Implementation of Alternative B and Alternative C pose minimal short-term risk to human health and the environment.

Implementability - Alternative A is more readily implementable than Alternative B or Alternative C because no action is required to implement this alternative. Alternative C can be implemented more readily than Alternative B because all that is required to implement this alternative is excavation of creek bottom soils with residual concentrations higher than the site-specific, risk-based concentrations established by the Ecological Risk Assessment and transfer of these soils to the on-site containment cell. Both of these alternatives are implementable with conventional materials and equipment.

Cost - No costs are associated with Alternative A. Alternative B ($667,889) is less expensive than Alternative C ($1,330,295) on a 30-year present value basis and provides similar protection of public health and the environment.

Estimated costs for each alternative are summarized below:

Project Element	Alternative B (Containment)	Alternative C (Removal)
Institutional Controls	155,113	155,113
Monitoring	453,426	453,426
Remedial Action	46,423	697,264
Operation and Maintenance	12,927	24,492

30-Year Present Value Cost	$667,889	$1,330,295

2. **Given the uncertainty related to the limited number of on-site site fish samples (1 for CSB, 1 for CSD, and 3 for BPL), averaging the calculated compound-specific BSAFs is not sufficient to characterize the range of uncertainty. Please provide results using the maximum BSAF as well as the average BSAF in the evaluation in order to assess the sensitivity to that parameter. Rationale should be provided for not using all 12 fish samples from the BPL in this analysis. This issue is described more extensively in our comments on Volume 3.**

Response: See Ecological Risk Assessment Response to Comments 1 and 15

3. ***It is not clear whether the reference area samples were included in the averages. If they were, they should be removed.***

Response: See Ecological Risk Assessment Response to Comment 2

4. **No evaluation of potential leaching of contaminants from creek bottom soils to groundwater is presented. This was described in our suggested outline of report contents and discussed in conference calls prior to production of the Dead Creek EE/CA. Evaluation of potential leaching is particularly relevant for Site M, where impacted sediments were apparently left in place and covered by clean fill.**

Response: See Ecological Risk Assessment Response to Comment 6

5. **The proposed site-specific, risk-based sediment concentrations that were used to determine the need for additional remediation should be presented in the main text. The proposed site-specific, risk-based sediment concentrations for metals and DDT presented in Table 4-1 of the residual ecological risk assessment (Volume 3) are 1 to 2 orders of magnitude higher than consensus-based concentrations that are considered to be protective of aquatic life. The following table compares the proposed site-specific concentrations to the consensus values presented in MacDonald et al (2000):**

Compound	Table 4-1 (Volume 3) Predicted Risk-based Sediment Concentration (mg/kg)	Consensus-based PEC for aquatic life (MacDonald et al, 2000) (mg/kg)
Copper	24,792	149
Lead	3,150	128
Mercury	No value	1.06
Zinc	4,739	459
Total PCBs	0.58	0.676
Total DDT	4.1	0.062
Total PAHs	No value	23

While the MacDonald et al (2000) values are not intended as absolute upper limits to potential risk-based sediment standards, insufficient rationale has been provided to support such a large departure from values that have been rigorously evaluated at other sites. In particular, no sensitivity analysis has been provided and inappropriately non-conservative parameters have been selected for food-chain modeling. The recommended analyses presented in our detailed comments on the residual ecological risk assessment (Volume 3) should be performed and the results summarized in the main text in order to justify the transects selected for further remedial action.

Response: See Engineering Evaluation/Cost Analysis Response to Comment 1 and Ecological Risk Assessment Response to Comment 4

6. **Mercury, dioxin (as TEQ) and total PAH site-specific, risk-based concentrations have not yet been proposed. As these compounds are known to be bioaccumulative, site-specific, risk-based concentrations should be evaluated in this EE/CA.**

Response: See Ecological Risk Assessment Response to Comment 5

7. **1 part per million for total VOCs, total SVOCs, total pesticides, and total herbicides is used as a de facto screening concentration in many parts of the document. A concentration of 1000 ppm for metals is also used as a de facto screening value. In other parts of the document, values of 10 ppm for organics and 100 ppm for inorganics are used. Rationale for selection of these values rather than the site-specific, risk-based concentrations developed in Volume 3 should be provided.**

Response: Concentration categories, e.g. metals concentrations greater than 1000 ppm, were used in Section 2.3.1 Sediments and Section 2.3.4 Soil of the site characterization portion of the EE/CA to describe the nature and extent of sediment and soil contamination. Using concentration categories to describe the extent of migration in Section 2.0 Site Characterization of the EE/CA is considered appropriate because it provides an effective description of the distribution of constituents in the sediment and soil migration pathways. It is not considered appropriate to use sediment screening levels or site-specific, risk-based concentrations to describe the extent of migration in sediments and soils because these criteria are appropriately used to establish the location of sediments or soils that might cause or are causing an unacceptable ecological impacts due to the presence of site-related constituents. Consequently, they are suitable for describing the extent of impact but they are not suitable for describing the extent of migration. Therefore, they were not used in Sections 2.3.1 and 2.3.4. However, screening levels and site-specific, risk-based concentrations are appropriately used in the Ecological Risk Assessment (Section 1.6 and Section 2.4.2 of the EE/CA) to determine those portions of the Dead Creek channel that require additional remedial action to protect the environment, i.e. the extent of impacted creek bottom soils.

SPECIFIC COMMENTS

8. ***Page 1-1, Section 1.1*: The text in the Introduction describes the requirements of the Unilateral Administrative Order (the Order). Among the requirements is the removal of materials from Site M. According to the text of the report, this was not done and Site M was backfilled with "clean fill." Rationale for not performing the work required by the Order should be provided. This comment also applies to Section 2.1.**

Response: All sediments were removed from Site M during implementation of, and as required by, the Time-Critical Sediment Removal Action UAO. As sediment was removed from Site M, clean soil was placed in the excavated area to stabilize the site. To clarify the nature of the removal action performed at Site M, the following sections of the EE/CA will be rewritten as indicated below and incorporated verbatim in the revised document:

1.3.5 2002 CS-B, C, D, E and F and Site M Sediment Removal Action

USEPA issued a UAO on May 31, 2000 for a Time-Critical Removal Action of sediments in Creek Segment B, C, D and E and Site M to eliminate potential risks associated with flooding and to eliminate adverse ecological impact. On August 29, 2001, the UAO was amended to include sediments in CS-F between Route 157 (Camp Jackson Road) and the confluence of Dead Creek with the Borrow Pit Lake and sediments in the Old Prairie du Pont Creek lift station sump in the sediment removal action. Work under this order continues.

1.4.4 Creek Bottom Soil

As sediment was removed from Site M during the Dead Creek Sediment Removal Action, the excavated area was backfilled with three feet of clean soil to stabilize the site. Soils containing residual constituent concentrations are isolated from the environment by this clean soil. Trespasser contact with these soils is prevented by the clean soil cover and existing fencing around Site M. Worker exposure will be controlled with institutional controls.

2.2.5 2002 CS-B, C, D, E and F and Site M Sediment Removal Action

USEPA issued a UAO on May 31, 2000 for a Time-Critical Removal Action of sediments in Creek Segment B, C, D and E and Site M to eliminate potential risks associated with flooding and to eliminate adverse ecological impact. On August 29, 2001, the UAO was amended to include sediments in CS-F between Route 157 (Camp Jackson Road) and the confluence of Dead Creek with the Borrow Pit Lake and sediments in the Old Prairie du Pont Creek lift station sump in the sediment removal action.

A Time Critical Removal Action Work Plan was submitted to the Agency on June 30, 2000 and approved in April 2001. On-site work began in November 2000 with the installation of a sediment dewatering system. Pursuant to USEPA's acceptance of the work plan and associated designs, a 50,000 cubic yard, RCRA/TSCA-compliant, on-site containment cell was constructed in 2001 adjacent to the west bank of Creek Segment B immediately south of Site G. Sediment transfer to the cell began shortly after Agency approval of the completed containment cell in September 2001.

As of February 2002, all sediments were removed from CS-B, C, D and E, the channel portion of CS-F, Site M and the lift station sump at Prairie du Pont Creek and transferred to the on-site containment cell. A temporary cover was placed on the cell pending evaluation of human health and ecological risks, if any, associated with creek bottom soils and completion of the removal action. A total of 46,000 cubic yards of impacted sediments were removed from Dead Creek.

Additional removal actions for creek bottom soils are necessary as described in later in this report.

2.3.4 Creek Bottom Soil

Site M - Site M is located along the eastern side of Dead Creek Segment B (south of Site L) at the western end of Walnut Street in the Village of Cahokia. Site M was originally a sand borrow pit in the middle to late 1940s. Prior to the Dead Creek Time Critical Sediment Removal Action, Site M was hydraulically connected to Dead Creek through an eight-foot opening at the southwest portion of the pit. As sediments were removed from Site M during implementation of the Time Critical Sediment Removal Action, clean soil was placed in the excavated area to stabilize the bottom of this impoundment. After completion of sediment removal, the clean soils placed in Site M were vegetated. During high-water conditions, it will act as a storm water detention basin with a capacity of 4.6MM gallons of water. Fencing, installed by USEPA and Solutia, restricts access to the site.

Nature and Extent of Soil Contamination - Zinc is ubiquitous in Dead Creek bottom soil, occurring at concentrations greater than 1,000 ppm in 57 out of the 66 sampling transects in CS-B, C, D, E and F. There are a few areas of isolated impacted soils in Creek Segments B, D, E and F and Site M where total organic constituent concentrations are greater than 1 ppm and Copper, Lead and Nickel concentrations are greater than 1,000 ppm:

• **Creek Segment B**	T0, T1, T2, T3, T4, T5	VOCs, SVOCs, PCBs, Copper
	T6, T7	Herbicides
	T9	Herbicides
	T12	SVOCs
	T16	Copper
• **Site M**	S3 to S10	VOCs, SVOCs Pesticides, Herbicides, PCBs Copper, Nickel
• **Creek Segment D**	T6	VOCs, Pesticides, PCBs, Copper
• **Creek Segment E**	T16, T17	SVOCs, PCBs, Copper
• **Creek Segment F**	T3	SVOCs
	T11	Herbicides
	T14	SVOCs

Creek bottom soil samples CS-B T0 to T5 were collected from the northern end of Creek Segment B adjacent to Site G. After sediment removal, a plastic liner was installed and the channel was backfilled with dense-grade gravel. Samples T6, T7, T9, T12 and T16, which are isolated areas of impacted creek bottom soil, were collected 600, 700, 900, 1200 and 1600 ft. south of the north end of the 1800 ft. long channel. Section V.3.B.5, Excavated Areas Bottom Liner Requirements, of the Dead Creek Sediment Removal Action UAO requires the following actions in Creek Segment B after sediment removal:

> "After excavation and sampling, Respondents shall properly install and maintain a 40 mil, HDPE liner in CS-B of Dead Creek."

Impacted soils at T0 to T5, T6, T7, T9, T12 and T16 will be isolated from the environment by installation of the channel liner described in Appendix 1. Trespasser contact with these soils will be prevented by installation of rip-rap on top of the HDPE liner and maintenance of existing fencing around Creek Segment B. Worker exposure will be controlled with institutional controls.

Section V.3.B.5, Excavated Areas Bottom Liner Requirements, of the Dead Creek Sediment Removal Action UAO also requires the following actions after sediment removal:

> "A liner shall be installed in other excavated areas of Site M and CS-C, D, E and a portion of F, and the basin area located at the lift station, as determined to be necessary based on post-excavation sampling to isolated impacted soils from surface water."

During performance of the Time Critical Sediment Removal Action at Site M, clean soil was placed in excavated areas immediately after sediment removal in order to stabilize the bottom of this impoundment. All sediments were removed from Site M during implementation of the Time Critical Sediment Removal Action. After completion of sediment removal and stabilization of Site M with clean soil, Site M was backfilled with three feet of clean soil in order to complete stabilization of the site. Impacted soils at S3 to S10 are isolated from the environment by this clean soil. Trespasser contact with these soils is prevented by the clean soil cover and existing fencing around Site M. Worker exposure will be controlled with institutional controls.

Creek Segment F creek bottom soil samples T3, T11 and T14 are isolated impacted areas that can be controlled by excavation and transfer to the on-site containment cell if the Human Health and Ecological Risk Assessments indicate that exposure to these soils may result in actual or potential human health or ecological impacts in excess of acceptable risk ranges.

9. ***Page 1-1, Section 1.1*: The text of the Order also states that a membrane liner is to be placed over CS-B, and in all other areas where such a liner is determined to be necessary. However, only limited portions of CS-B are recommended for lining in later sections of the EE/CA. Rationale for modifying the requirements of the Order should be provided. This comment also applies to Section 2.1.**

Response: Nothing in the EE/CA was intended to modify the requirements of the Order nor can the EE/CA, in and of itself, modify the Order. Only USEPA can modify the Order. Based on the results of the Ecological Risk Assessment, only limited portions of Creek Segment B need to be isolated or removed in order to protect the environment. These portions were carried through the EE/CA even though the Time Critical Sediment Removal Action UAO requires the lining of all of Creek Segment B.

To ensure that the EE/CA does not appear to modify the requirements of the Order, Sections 1.0, 5.0 and 6.0 of the EE/CA will be modified as indicated in the Response to Comment 1 above.

10. ***Pages 1-6 to 1-7, Section 1.2.3, hydrology and hydrogeology*: The hydrologic interaction between Dead Creek and the shallow aquifer system should be described. This is particularly relevant to the design of a potential creek-bed liner and to the evaluation of potential impacts on Dead Creek by contaminated groundwater.**

Response: Section 1.2.3 Hydrogeology will be expanded as shown below:

Groundwater beneath Sauget Area 1 flows generally from east to west, toward the Mississippi river. Horizontal groundwater gradients beneath Sauget Area 1 average about 0.001 feet per foot (ft/ft) to the west. Downward vertical gradients occur on parts of the site, with varying magnitudes depending on location and season. Based on depth to water measurements made during the third and fourth quarters of 1999 and the first and second quarters of 2000 as part of the Sauget Area 1 Support Sampling Plan, depth to groundwater in the study area ranges from 7.3 to 25.5 feet below ground surface. Groundwater elevation ranges from 390.8 to 399.0 feet above mean sea level with ground surface elevations ranging from 405 to 416 feet above mean sea level. Groundwater level fluctuations of 2.4 feet and 4.6 feet were observed between Fall

1999 and Spring 2000 during SSP data collection activities. Highest and lowest depth to water and groundwater elevation data collected during the SSP are summarized below:

	Depth to Water (feet below ground surface)		Groundwater Elevation (feet above mean sea level)	
	Highest	Lowest	Highest	Lowest
Third Quarter 1999	7.3	20.9	399.0	395.4
Fourth Quarter 1999	8.6	23.7	397.7	392.6
First Quarter 2000	9.7	25.5	396.6	390.8
Second Quarter 2002	NA	NA	401.8	392.8

Historical records of groundwater levels during high surface water levels are limited, however, some information is available. In August 1993, surface water level in the Mississippi River at St. Louis peaked at 429.4 ft. amsl, the highest recorded flood level. Groundwater elevation at Solutia's W.G. Krummrich plant was 405 ft. amsl during this flood. In 1981 and 1982, respectively, flood levels in the Mississippi River were 410 and 412 ft msl while groundwater levels at the Krummrich plant were 398 and 400 ft. msl.

11. ***Page 1-10, Sensitive Habitats*: Consistent with comments on the residual ERA (Volume 3), replace the text with the following paragraph:**

    The Sauget 1 site lies within the flood plain area of the Mississippi River, referred to in this region as the American Bottom, one of the largest areas of flood plain along the Mississippi flyway. The American Bottom is important for migratory birds and other wildlife for habitat and food resources and is currently threatened by habitat fragmentation. Within the American Bottom, Dead Creek is a primary tributary that provides drainage to the Mississippi. Dead Creek is also used by a variety of birds, mammals and invertebrates. Several federal and state listed species have been noted or could potentially use the habitat provided by Dead Creek and Borrow Pit Lake. Listed species noted at the site on a two-day survey in November 2000 include black-crowned night heron, brown creeper, and early wild rye. Bald eagles are also known to use the area.

    This comment also applies to pages 2-22 to 2-23

Response: See Response to Ecological Risk Assessment Comment 12

12. ***Pages 1-16 to 1-17, Section 1.4.3*: Contrary to the text in the final paragraph of Section 1.4.3, the presence of SVOCs above Class I standards at the sampling location adjacent to Site M indicates the potential for leaching of contaminants from sediments to groundwater. This text also states that "the removal of impacted sediments in Dead Creek Segments B, C, D, E, and F and Site M eliminated any future potential for migration by this route." Descriptions on page 1-18 and in Section 2, however, appear to indicate that impacted sediments were not removed from Site M,**

but were left in place and covered by 3 feet of "clean fill." The discrepancy between the described removal actions for Site M should be reconciled.

If impacted sediments were left in place in Site M, the potential for future leaching from this source was not eliminated. The statement that this pathway was eliminated for the residual creek-bed soils is unsubstantiated by any scientific or technical evaluation and should be removed. The potential for leaching from soils or residual impacted sediments to groundwater should be quantitatively evaluated for all creek segments and Site M.. This was recommended in our suggested outline and in conference calls prior to production of this report.

Response: See Response to Comments 4 and 8

13. ***Page 1-17, first complete paragraph on page*: Replace the word "exposure" in the last sentence of this paragraph with "exposed."**

Response: This paragraph will be modified as shown below:

"These data indicate that constituent transport from sediments to groundwater water is not a significant pathway of concern. Removal of impacted sediments in Dead Creek Segments B, C, D, E and F and Site M eliminated any future potential for migration by this route. Since constituent transport from sediments to groundwater was not a significant pathway of concern when impacted sediments were in place, it is unlikely that constituent transport from creek bottom soils, which have lower constituent concentrations than the former impacted sediments, to groundwater will be a significant pathway now that they are exposed to the water column."

14. ***Pages 1-17 to 1-18, Section 1.4.4*: The portions of Dead Creek requiring lining or further corrective action may change depending on the results of the sensitivity analysis and the evaluation of mercury, dioxins, and total PAHs (see comments #0 and #6 above). This comment also applies to page 2-54.**

Response: See Response to Comments 1 and 6

15. ***Page 1-18, Section 1.4.4, first full paragraph on page*: As discussed in comment #9 above, rationale should be provided for not lining all of CS-B as apparently required by the Order.**

Response: See Response to Comment 9

16. ***Page 1-20, Section 1.5*: The acronyms "RME" and "MLE" should be defined. Both tables on this page are described as applying to a recreational teenager. The text should be checked and appropriate modifications made to include the evaluation of the construction worker. This comment also applies to pages 2-62 to 2-63.**

Response: Section 1.5 Human Health Risk Assessment will be modified as follows:

1.5 Human Health Risk Assessment

ENSR conducted the Human Health Risk Assessment (HHRA) in accordance with the USEPA approved August 6, 1999 Sauget Area 1 EE/CA and RI/FS Support Sampling Plan HHRA Work Plan. It was performed using data from creek bottom soil samples collected from the study area after completion of sediment removal (Section 2.3.4). Samples were collected and analyzed in accordance with the methods, procedures and protocols included in the September 9, 1999 Sauget Area 1 Support Sampling Plan, Field Sampling Plan, Quality Assurance Project Plan and Health and Safety Plan. Background or reference area sediment sample analytical results from the January 2001 Sauget Area 1 EE/CA and RI/FS Support Sampling Plan Data Report were also used in this HHRA.

VOCs, SVOCs, Pesticides, Herbicides, PCBs, Dioxin, Metals, Mercury, Cyanide analytical results were evaluated for inclusion in the HHRA during the data evaluation and hazard identification process of the HHRA. Based on this evaluation, sixteen Constituents of Potential Concern (COPCs) were identified. In addition to PCBs and Dioxin, the COPCs included the following constituents:

SVOCs

- 1,4-Dichlorobenzene
- 4-Nitroaniline
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Bis(2-ethylhexyl)phthalate
- Dibenzo(a,h)anthracene
- Pentachlorophenol

Metals

- Arsenic
- Copper
- Nickel

Pesticides

- Dieldrin
- Heptachlor
- Heptachlor epoxide

No constituents of concern were identified in Creek Segment C; all constituents present in CS-C creek bottom soils were screened out during the COPC identification process.

Access to Dead Creek is generally uncontrolled except for Creek Segment B, which is secured with a fence. Therefore, two exposure scenarios were evaluated in the HHRA: 1) a recreational receptor (i.e., teenager) exposed to COPCs in the creek bottom through wading or swimming and 2) a construction worker exposed to soil during excavation activities in the creek channel. Risks were estimated for both Reasonable Maximum Exposure (RME) and Most Likely Exposure (MLE).

Potential carcinogenic risks for a recreational teenager exposed to creek bottom soils in Creek Segments B, D, E and F and pond bottom soils in Site M are within the target risk range of 1E-6 to 1E-4.

	Potential Risk		Hazard Index	
	RME	MLE	RME	MLE
CS-B	1.95E-06	6.61E-07	2.77E-02	1.25E-02
CS-D	7.30E-07	7.02E-08	3.58E-02	2.91E-03
CS-E	1.69E-07	3.77E-08	9.78E-03	1.69E-03
CS-F	1.40E-07	3.29E-08	1.84E-03	4.18E-04
Site M	2.23E-05	2.32E-06	2.19E-01	2.68E-02

Hazard Indices for each segment are less than 1.0.

Potential carcinogenic risks for a construction worker exposed to creek bottom soils in Creek Segments B, D, E and F and pond bottom soils in Site M are within the target risk range of 1E-6 to 1E-4.

	Potential Risk		Hazard Index	
	RME	MLE	RME	MLE
CS-B	2.56E-07	9.78E-08	3.67E-02	2.17E-02
CS-D	7.89E-08	9.17E-09	4.74E-02	4.46E-03
CS-E	1.78E-08	4.94E-09	1.14E-02	2.48E-03
CS-F	1.40E-08	4.16E-09	1.98E-03	5.71E-04
Site M	4.00E-06	3.62E-07	4.58E-01	4.27E-02

Hazard Indices for each segment are less than 1.0.

Based on the results of this baseline risk assessment, it is considered appropriate that no further remedial action is necessary to protect human health in Creek Segments B, C, D, E and F and Site M.

17. ***Page 1-21, Section 1.6, first paragraph*: The text states in part that impacted sediments in Site M were removed down to native soils. Elsewhere, Site M is described as having no excavation, with impacted soils covered by 3 feet of clean fill. This discrepancy should be resolved and the correct description for remedial action at Site M used throughout the document.**

Response: See Response to Comment 8

18. ***Page 1-22, Section 1.6*: This analysis should include maximum BSAF values in addition to the average BSAF values in order to evaluate the sensitivity of the results to that parameter (see comment #0 above and comments on Volume 3). If the regression-equation evaluation included the reference area fish samples, this evaluation should also be repeated with only the on-site samples. Finally, mercury should be evaluated because 1999 sediment and fish concentrations both exceeded values known to pose ecological risk. The portions of Dead Creek requiring further corrective action may change depending on the results of these evaluations.**

Response: See Engineering Evaluation/Cost Analysis Response to Comments 1 and 2 and Ecological Risk Assessment Response to Comments 1, 5, 14, 15, 16, 17, 18, 19 and 22

19. **Page 1-22, first full paragraph: The purpose of sampling is to characterize a larger spatial area. Listing sediment samples that need to be isolated or removed to achieve a cleanup goal is inappropriate. Presumably, these samples have already been removed and sent to the laboratory for analysis. It is the areas that the samples are supposed to represent that need to be isolated or removed and should be described. Please revise the text accordingly. This comment also applies to page 2-65.**

Response: See Response to Comment 1

20. **Page 1-23, Notes to preceding table: Creek-channel width in CS-C is shown as 50 feet. However, CS-C is not proposed for further action. Please replace with the typical width assumed for CS-F. This comment also applies to page 2-65.**

Response: See Response to Comment 1

21. **Pages 1-26 to 1-27, Section 1.7.3: Compliance with ARARS is described for the three alternatives. However, no ARARs are listed or described. ARARs for the Dead Creek EE/CA should be listed in order to evaluate compliance of the alternatives.**

Response: Section 1.7.3 Compliance with ARARs will be expanded as shown below:

Compliance with ARARs - Alternative B and Alternative C achieve compliance with ARARs. ARARs evaluated include the following chemical-specific, location-specific and action-specific ARARs:

Chemical-Specific ARARs:

ARAR	Description	Applicability
40 CFR 261 (35 IAC 721)	Methods for identifying hazardous waste	Relevant and Appropriate
40 CFR 268 (35 IAC 728)	Rules regarding disposal, including land disposal restrictions, for specified hazardous wastes	Relevant and Appropriate
40 CFR 761	Rules governing management, disposal and cleanup of PCB-containing wastes	Relevant and Appropriate
40 CFR 766	Testing procedures for dioxin	Relevant and Appropriate

Location-Specific ARARs:

ARAR	Description	Applicability
40 CFR 264.18	Standards for hazardous waste management activities in specific locations such as 100-year floodplains	Relevant and Appropriate
40 CFR 6	Procedures for evaluating actions to avoid adversely impacting floodplains, endangered species, wetlands and other protected resources	Applicable
33 CFR 323 **40 CFR 230**	Restrictions on discharge of fill material into wetlands	Relevant and Appropriate

Action-Specific ARARs:

ARAR	Description	Applicability
40 CFR 262 **40 CFR 263** (35 IAC 722) (35 IAC 723)	Rules regarding generation and transportation of hazardous waste	Relevant and Appropriate to Excavation but not to Channel Liner
40 CFR 761	Rules governing management, disposal and cleanup of PCB-containing wastes	Relevant and Appropriate
29 CFR 1910.120	Employee safety standards for hazardous waste/ emergency response work	Applicable
29 CFR 1926	Employee safety standards for construction work	Applicable
35 IAC 742	Provides for a tiered approach to developing remediation action objectives and describes how certain actions meet remediation objectives	To Be Considered

22. Pages 2-12 through 2-14, hydrology and hydrogeology: The interaction between groundwater and Dead Creek surface water should be described. See comment #10 above.

Response: See Response to Comment 10

23. Page 2-22, Sensitive Habitats: See comment #11 above.

Response: See Response to Ecological Risk Assessment Comment 12

24. Page 2-51, last paragraph: The parenthetical reference to "Section 2.3.4 below" should be checked and corrected. The text on this page is within Section 2.3.4.

Response: This paragraph will be corrected as follows:

"While the November 30, 2001 modification of the post-removal soil sampling requirements changed the number of samples collected, the analyte list required by the UAO was not changed, i.e. "extracted using TCLP and analyzed for Total Compound List/Total Analyte List (TCL/TAL) parameters and dioxin/furans". TCLP extraction and analysis was selected as the analytical method in the UAO because "Due to the fact that soils leaching to groundwater is the primary concern, bottom soil samples shall be extracted using TCLP". During performance of the Sauget Area 1 Time-Critical Sediment Removal Action and the Sauget Area 1 EE/CA and RI/FS, it became apparent that Dead Creek had little or no impact on shallow groundwater (Section 2.3.3 above) and that total concentration analyses of creek bottom soil samples was needed to meet the UAO requirement that "The post removal sampling results will be used in the Area One EE/CA and RI/FS process to determine what, if any, excavated areas in addition to CS-B may require further remediation under the EE/CA process.". For this reason, sample analyses were done on a total concentration basis not on a TCLP-extract basis. To address the issue of leaching to groundwater, 10 percent of the samples were to have both total concentration analyses and TCLP-extract analyses. Unfortunately, a misunderstanding between field sampling personnel and the analytical laboratory resulted in the laboratory analyzing the TCLP-extract samples for only TCLP parameters, not TCL/TAL parameters as required by the UAO.

While these TCLP analyses do not characterize all of the TCL/TAL constituents that might leach from creek bottom soils, they do characterize enough of these constituents to allow an evaluation of creek bottom soil leachability using the TACO Tier 2 Soil to Groundwater Remedial Objective process. Based on this process, 1,1,2,2-Tetrachoroethane, Cadmium, Dieldrin, Nitrobenzene and Pentachlorophenol are predicted to leach to groundwater at concentrations greater than the TACO Tier 1 Groundwater Remedial Objectives. Comparison of observed concentrations of these constituents at eight groundwater sampling stations downgradient or in the vicinity of Creek Segment B and Site M indicates that none of these constituents are present at concentrations higher than TACO Tier 1 Groundwater Remedial Objectives. Therefore, residual constituent migration via this pathway is not considered likely and additional remedial action in Creek Segment B and Site M, other than installation of the liner required by the Time Critical Sediment Removal Action UAO, is not considered necessary in Creek Segment B. Therefore, Creek Segment B will not be carried through the EE/CA process. Results of this analysis are presented in the Appendix 1.

25. Page 2-54 to 2-55, Site M: The description of the removal action should be clarified to state whether any soils were removed from Site M or not (see comments #8, #12, and #17 above). The source of the "clean soil" used to backfill Site M should be

described, along with any sampling and analyses performed to verify that the fill was indeed clean.

Response: See Response to Comments 8, 12 and 17. Clean soil was obtained from property located east of Site M and immediately north of the residential area along Walnut Street. This parcel of land was used for agricultural purposes until purchased by Solutia for use in performance of the Sauget Area 1 EE/CA and RI/FS Support Sampling Plan and the Dead Creek Time-Critical Removal Action. Six soil samples were collected in this area (UAS-T2-S1 to S6) as part of the Sauget Area 1 EE/CA and RI/FS Support Sampling Plan and the analytical results were included in the Sauget Area 1 EE/CA and RI/FS Support Sampling Plan Data Report. No human health or ecological risks were identified for these soils in the Sauget Area 1 Human Health Risk Assessment and Ecological Risk Assessment. Soil from this borrow area was allowed to be used to stabilize Site M by the USEPA On Scene Coordinator.

26. **Page 2-55, first full paragraph, third sentence: The word "where" should be changed to "were" in this sentence. The revised sentence should read, "Total VOCs, Total SVOCs, Total Pesticides and Total Herbicides were detected at concentrations greater than 1 ppm..." (emphasis added for clarity).**

Response: This paragraph will be corrected as indicated below:

"PCBs were detected at a concentration greater than 1 ppm in 8 out of the 9 pond bottom soil sampling locations in Site M. PCB concentrations ranged from 1.003 to 27.138 ppm. Zinc was observed in concentrations ranging from 1,200 to 12,000 ppm at the 6 sampling locations with zinc concentrations greater than 1,000 ppm. Total VOCs, Total SVOCs, Total Pesticides and Total Herbicides were detected at concentrations greater than 1 ppm in isolated locations but there is no apparent distribution pattern to these detections with two exceptions. Samples S7 and S10 may represent isolated areas of impacted soils. S7 has Total VOC and Total SVOC greater than 1 ppm and Copper, Lead, Nickel and Zinc concentrations greater than 1,000 ppm. Total SVOC, Total Pesticide and Total Herbicide concentrations are greater than 1 ppm in S10 and Copper, Nickel and Zinc concentrations are greater than 1,000 ppm."

27. **Page 2-55, last paragraph: Because impacted soils were left in place and the available data indicates a potential for leaching to groundwater, we cannot agree that Site M "should pose no risk to public health and welfare." The potential for leaching from the impacted soils left in place to result in groundwater concentrations above relevant standards should be quantitatively evaluated as suggested in our recommended outline provided prior to the preparation of this document. See comment #12 above.**

Response: See Response to Comments 4, 8, 12 and 24

28. **Page 2-60, Nature and Extent of Soil Contamination: Rationale should be provided for selecting the screening concentrations of 1 ppm total organics and 1000 ppm for zinc. The nature and extent of contamination should be determined by the site-specific, risk-based criteria developed in Volume 3, not arbitrary benchmarks.**

Response: See Response to Comment 7

29. **Page 2-63: *See comment #16 above.***

Response: See Response to Comment 16

30. **Page 2-64 to 2-65: See comments #18, #19, and #20 above.**

Response: See Response to Comments 18, 19 and 20

31. **Page 2-67, tabulated mercury values: The tabulated summary of mercury concentrations in biota indicates ND for one CS-B sample, and 0.018 mg/kg for one CS-D sample. All other samples show as "NS," presumably meaning not sampled or not analyzed. The table at the bottom of the page is captioned "Average Mercury Concentrations in Sediment and Biota (Whole Body), mg/kg." The "average" value for biota in CS-B is listed as 0.042 mg/kg, and the "average" value for biota in CS-D is listed as 0.028 mg/kg. The discrepancy between the values shown in the "Average" table and the single values shown in the "Summary" table should be resolved. "Averaging" a single detected value, or a single non-detected value in the case of the sample from CS-B, has no statistical power. Conclusions drawn in the text on page 2-67 on the basis of these numbers are without basis and should be deleted. As discussed in comment #18 above and more extensively in our comments on Volume 3, mercury must be evaluated as part of the residual ERA for Dead Creek soils.**

Response: Section 2.4.2 Ecological Risk Assessment will be rewritten as shown below:

2.4.2 Ecological Risk Assessment

Menzie-Cura & Associates, Inc. evaluated ecological risks due to Dead Creek bottom soils exposed after completion of the Dead Creek Sediment Removal Action, which removed impacted sediment down to native soils in Creek Segments B, C, D and E, the channel potion of Creek Segment F, Site M and the lift station sump at Prairie du Pont Creek.

Sediment and forage fish tissue analytical data from the Sauget Area 1 EE/CA and RI/FS Support Sampling Plan were used to calculate site-specific sediment to fish uptake values for bioaccumulative constituents detected in sediment and fish. These site-specific uptake factors, in conjunction with literature values for body burdens in fish associated with toxic effects, were used to back-calculate risk-based creek bottom soil concentrations protective of fish. These site-specific uptake factors were also used in food chain models to calculate risk-based creek bottom soil concentration protective of great blue heron. No risks were predicted for the river otter.

Risk-based concentrations were calculated for the following bioaccumulative COCs, which were selected by Waterstone Environmental, USEPA's oversight contractor for the Ecological Risk Assessment:

- **SVOCs** Total PAHs
- **Pesticides** Chlordane, DDT, Dieldrin
- **PCBs** Total PCBs
- **Dioxin** Dioxin TEQ
- **Metals** Mercury

Risk-based concentrations were compared to the 95% UCL concentrations in creek bottom soils for each creek segment except in Creek Segments C and D, where the maximum concentration was used because not enough data were available to calculate UCLs. Risks due to PAHs and PCBs were identified in Creek Segment B and risks due to PCBs and Dioxin were identified in Creek Segment D. If Transects T0, T3, T12 and T16 were removed from the CS-B creek bottom soil data set and Transect T6 was removed from the CS-D data set, UCLs in both creek segments would be below risk-based concentrations.

In summary, results from the Ecological Risk Assessment indicate that the transects listed below need to be isolated or removed from the creek channel in order to reduce potential ecological impacts resulting from impacted creek bottom soils to acceptable levels:

Creek Segment	Transects	Risk Driver
CS-B	T0, T3	PAHs, PCBs
	T12, T16	PAHs
CS-D	T6	PCBs, Dioxin TEQ

Since the Time Critical Sediment Removal Action UAO (Docket No. V-W-99-C-54) requires lining of Creek Segment B, it is not necessary to take additional remedial action for creek bottom soils in this portion of Dead Creek to protect the environment other than to implement those remedial actions already required by the UAO. Specifically, the UAO requires the following:

> **Section 1. Jurisdiction and General Provisions** - "This Order also requires installation of a 40 millimeter [sic] (mil) high density polyethylene (HDPE) liner in CS-B and post removal sampling in all excavated areas. The post removal sampling results will be used in the Area One EE/CA and RI/FS process to determine what, if any, excavated areas in addition to CS-B may require further remediation under the EE/CA process."
>
> **Section V.3.B.5 Excavated Areas Bottom Liner Requirements** - "After excavation and sampling, Respondents shall properly install and maintain a 40 mil, HDPE liner in CS-B of Dead Creek. A liner shall be installed in other excavated areas of Site M and CS-C, D, E, a portion of F, and the basin area located at the lift station, as determined to be necessary based on post-excavation sampling to isolate impacted soils from surface water."

Installation of an armored, 40-mil, HDPE liner in CS-B will isolate creek bottom soils with residual constituent concentrations higher than the site-specific, risk-based concentrations needed to protect fish and piscivorous birds and mammals. Installation of an armored liner in CS-B will prevent: 1) isolate residual constituent concentrations in creek bottom soils and prevent contact with surface water and the aquatic ecosystem, 2) transport of residual constituent concentrations in creek bottom soils to other exposure points via the surface water pathway, 3) leaching of residual constituent concentrations in creek bottom soils via the surface water to groundwater migration pathway and 4) discharge of impacted groundwater from Sauget Area 1 Sites G, H and L to surface water.

Installation of a liner in CS-B will not prevent the leaching of residual constituent concentrations from creek bottom soils by the rise and fall of the groundwater. However, residual constituent migration via this pathway is not likely based on a comparison of predicted leaching concentrations and concentrations actually observed in groundwater downgradient of and adjacent to CS-B. Using the TACO Tier 2 Soil to Groundwater Remedial Objective process, 1,1,2,2-Tetrachoroethane, Cadmium, Dieldrin, Nitrobenzene and Pentachlorophenol are predicted to leach to groundwater at concentrations greater than the TACO Tier 1 Groundwater Remedial Objectives. Comparison of observed concentrations of these constituents at eight groundwater sampling stations downgradient or in the vicinity of Creek Segment B indicates that none of these constituents are present at concentrations higher than TACO Tier 1 Groundwater Remedial Objectives. For this reason, additional remedial action, other than installation of the liner required by the Time Critical Sediment Removal Action UAO, is not considered necessary in Creek Segment B. Therefore, Creek Segment B will not be carried through the Feasibility Study process.

Based on the ecological risks identified by the revised Ecological Risk Assessment, it is considered appropriate to take additional remedial action at Creek Segment D Transect T6, which is located immediately upstream of Jerome Lane, to isolate or remove creek bottom soils with concentrations greater than site-specific, risk-based concentrations at this transect. Remediation area and volume for Creek Segment D Transect 6 are estimated below:

Creek Segment	Transects Exceeding Risk Based Concentrations	Upstream Clean Transect	Downstream Clean Transect	Impacted Channel Length (Feet)	Impacted Channel Area ($Feet^2$)	Impacted Channel Volume ($Yards^3$)
• **CS-D**	T6	T5	T6 (1	125	12,500 (2	3,700 (3,4,5

Notes:
1) Transect 6 is located at the downstream end of Creek Segment D
2) Typical creek channel width in CS-D = 100 feet
3) Typical creek channel bottom elevation = EL 398 ft. amsl
4) Typical low groundwater elevation = EL 390 ft. amsl
5) Typical excavation depth = 8 ft.

32. **Page 2-68, first paragraph: The text describes the measured value of 0.6 mg/kg mercury in one fish sample as an outlier. With the limited data set available for fish tissue, it is not possible to conclude that this is an outlier. In fact, a detected concentration of 0.6 mg/kg, above the screening level of 0.5 mg/kg, is significant with so few samples. The discussion of average values with or without this analysis should be deleted.**

Response: See Response to Comment 31

33. **Pages 2-68, second paragraph, through 2-70: The discussion of additional mercury sampling in the Borrow Pit Lake sediments is not relevant to this EE/CA and should be deleted. A separate Mitigation Plan has been prepared by the PRPs to describe and implement this work. Comments previously provided on the Mitigation Plan are applicable to this discussion and should be incorporated into the text if it is not removed.**

Response: See Response to Comment 31

34. **Figure 2-23: Units of measurement are listed as "ppq" in the legend, but the values posted on the figure appear to be in parts per million. This discrepancy should be resolved.**

Response: Dioxin TEQ concentrations are reported in units of parts per billion on Figure 2-23. The note included on this figure will be corrected as indicated below:

"Note: Units = ppb"

35. Figure 2-28: Addresses and/or sample location identifiers should be provided on the figure so that data in tables and discussions in the text can be referenced to the actual sample locations.

Response: From north to south, the sample numbers of the Residential Area Shallow Groundwater Sampling Locations shown on Figure 2-28 are:

- TS-S1-0HR, TS-S1-12HR, TS-S1-24HR
  SGW-S1-15FT, SGW-S1-20FT, SGW-S1-40FT
- DW-MCDO-1
- TS-S2-0HR, TS-S2-12HR, TS-S2-24HR
  SGW-S2-15FT, SGW-S2-20FT, SGW-S2-40FT
- DW-WRIG-1
- DW-SETT-1
- DW-SCHM-1

These sample numbers will be added to Figure 2-28.